

## Volume 3, Number 1 – January 14, 2009

### SCANNING THE HORIZON

We at **World Care Clinical** send you best wishes for a happy new year! In a departure from our regular format, this issue begins 2009 with a turn away from currently applied advances in medical imaging. Like a telescope surveying the landscape of the future, however near or far off it may be, this issue profiles experimental and theoretical studies in which imaging is – or could be – of importance. ■

– **Stephen J. Pomeranz, M.D., and Margaret D. Phillips, M.D., Contributing Editors**

#### MICRO- IMAGING ADVANCES

#### From the Scientific Locomotive, Some Bullets Fired into the Future

The macroscopic features depicted on current radiological imaging studies reflect processes occurring at the cellular and, ultimately, the molecular and micro-environmental levels. In this light, a number of more recent developments may ultimately influence the way we perceive and perform medical imaging — and may link some imaging techniques with disease interventions.

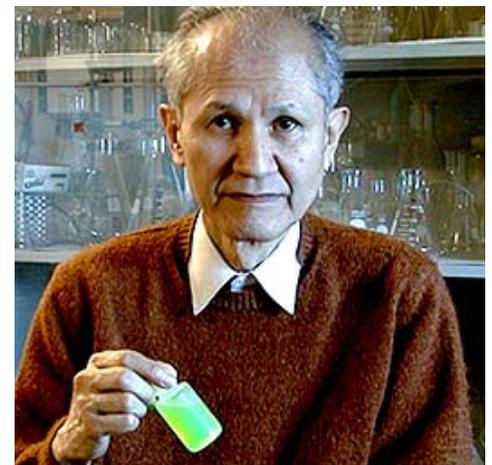
We begin the year by turning our lens toward the horizon. The following studies, briefly profiled, serve as a sampling of the past year's innovative literature. They depict the depth and promise of newer scientific paths that may gain increasing currency in the years to come.

#### Molecular and Microscopic Imaging

The year 2008 saw the Nobel Prize in Chemistry awarded for the discovery of, and research on, a green fluorescent protein (GFP) in jellyfish, a finding which ultimately changed the scale on which imaging could be done. This advance opened a door into the world of the minute — a path to structures of unprecedented small scale, affording cellular and molecular images of living organisms.<sup>1</sup>

On a poignant note, Nobel Laureate **Osamu Shimomura** was 16 years old and working in a factory just 15 kilometers from Nagasaki, Japan on August 9, 1945. As a high-school student, he watched the U.S. B-29 bomber fly in overhead, then survived the detonation of the atomic bomb.<sup>2</sup> Some recent studies based on fluorescent-tagged protein imaging include:

- Combining optics and genetics to evaluate neural circuit dynamics, with models created of Parkinson's disease, depression, and behavior relevant to autism.<sup>3</sup>
- Imaging individual mRNA molecules.<sup>4</sup>



**Nobel Laureate Osamu Shimomura, shown here holding a sample of green fluorescent protein (GFP).**

- Observation of the dynamics in space and time of nearly 1,000 proteins in individual human cancer cells responding to the chemotherapy drug camptothecin.<sup>5</sup>
- Observing the real-time assembly of individual virions in live cells, from initiation to budding and release.<sup>6</sup>
- Imaging small pancreatic ductal carcinomas and precursor lesions by exploiting cell-surface cancer proteins.<sup>7</sup>

**The ability to image cells and their microenvironment moved forward with studies such as these:**

- Imaging pH changes in cancer.<sup>8</sup>
- Real-time imaging of cells accompanying cancer.<sup>9,10</sup>
- Imaging the red-blood-cell membrane changes induced by malaria.<sup>11</sup>
- Developing MRI pulsing sequences that achieved rapid and accurate internal temperature images.<sup>12</sup>

**The pursuit of molecular cancer imaging included these advances:**

- Creation of a dual-head dedicated gamma camera used with 99mTc sestamibi to detect breast lesions less than 1 centimeter.<sup>13</sup>
- Development of a high-resolution positron emission mammography/tomography imaging and biopsy device to detect and diagnose breast cancer.<sup>14</sup>
- Engineering of gold nanoparticles targeted to tumor selective antigens, allowing cancer detection at the molecular level using standard CT imaging.<sup>15</sup>

As we commence the 2009 edition of *The WCC Note*, it is our intention to continue keeping you informed of the newest and most seminal imaging related literature. Throughout the year studies will be profiled that may directly or indirectly affect imaging's role in healthcare. We will examine new developments in imaging techniques, new hypotheses of disease process, and novel concepts of disease intervention — scientific advances which typically find their way to human use by first being tested in the clinical trial arena. ■

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